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Caustic Soda in the Finishing of Cotton Piece Goods

By WALLACE P. COHOE

The present generation of cotton bleachers and finishers look upon caustic soda as a commodity to be taken for granted and so it is today. Indeed it is difficult to realize that solid caustic freely obtainable everywhere is a comparatively recent product.

The old-time bleacher, not so happily placed, for securing a pure and low cost supply of caustic soda depended very largely upon lime and soda ash in his kier boil. Some plants, even today, adhere to the lime boil claiming that it produces a softer piece of cloth than the present caustic soda boil, although this softness of hand may be due to causes other than the employment of lime and soda ash.

In recent years, with these exceptions, the bleacher has gone over to the exclusive use of caustic soda. The procedure is more simple and caustic may be purchased freely in the open market.

OLD time users of caustic soda will not soon forget how necessary it was, even twenty years ago, to examine every drum to make sure that the manufacturer had not dipped too deeply into his finishing pot with a resulting contamination by the presence of "bottoms." The presence of these "bottoms," while embarrassing to the bleacher, was not fatal. To the rayon manufacturer, on the contrary, the presence of such impurities was intolerable and he said so. Today when caustic soda is sold in the form of a white solid or correspondingly clean solution, there is frankly little to be said by the purchasing public in criticism of quality. It is difficult to state definitely whether this standardization of quality came as a result of outside criticism or because caustic soda manufacturers competed with each other in the matter of quality. The fact remains that today standard 76 per cent caustic is a dependable and high grade product.

Caustic soda is now all made either by the action of lime on soda ash or electrolytically from salt. While there would seem to be little difference between the products as far as the cotton bleacher is concerned, it is surprising to find distinct partialities expressed. Some bleachers prefer the causticized article while others can never get satisfactory results except by the use of the electrolytic product. As explanations of these differences are characterized by more volubility than illumination, a disinterested observer is likely to conclude that "they have a zeal but not according to knowledge."

Care in purchasing may not always be followed by an intelligent use of the product purchased. No matter how careful the bleacher may be in seeing to it that every ton of caustic which comes into his plant is up to standard, there is still great danger that his subsequent efforts towards economy may result, not only in inefficient methods, but also in expensive damage. It is a natural economy to utilize the washings from the mercerization process in dissolving fresh caustic as it is also to employ the caustic content of these washes in the kier boil, but in so doing it is possible to overlook a property of caustic soda which may cause subsequent trouble. While caustic soda does not dissolve *alpha* cellulose of which bleached cotton is the type, it is frequently forgotten that *beta* and *gamma* cellulose are dissolved by caustic solutions of mercerizing strength. *Gamma* cellulose does not appear to be dangerous as it remains in solution and is probably all hydrolyzed. *Beta* cellulose, however, is precipitated upon dilution and it is this flocculent precipitate which causes damage.

Where counter current washing is employed on the mercerizing frame *beta* cellulose accumulates. If these washes should be used without purification in making up fresh caustic, the flocky precipitate will tend to redissolve and there will, naturally, come a time when the wash waters over the frame precipitate this accumulation of *beta* cellulose upon the fibres in such quantities as to produce a dull smear over the fibres which are being lustered.

Every bleacher is only too familiar with a peculiar resist which shows up only in the dye house. It is insoluble in all organic reagents and very few realize what it is.

It has, however, been definitely identified as *beta* cellulose. In a case studied, wash liquors from the mercerizing department were used in making up the kier liquors and from them *beta* cellulose was deposited in irregular patches upon the cloth. On light weight and open constructions there is less danger of these resists forming but heavier cloth, tightly woven, acts as a filter, in which case the resulting damage may be serious. A resort to the use of freshly dissolved caustic effects an immediate and permanent freedom from resist spots of this character.

Proper methods and careful supervision provide means whereby desirable and necessary economy in caustic soda may be effected while at the same time damage may be avoided. It has been definitely determined that *beta* and *gamma* cellulose carried by mercerization washes become totally hydrolyzed in their passage through the vacuum units of a recovery system. The products resulting from such hydrolysis are soluble and although they tend to give the concentrated solution a syrupy consistency, which may render hydrometer readings misleading, no harmful effects have been traced to their presence.

Wherever solid caustic is dissolved in the washings referred to above, the heat employed in and caused by the solution tends to effect an hydrolysis of these soluble forms of cellulose. Under these circumstances, it is readily understood why a rapid cooling of concentrated solutions is inadvisable. Strong cold solutions of caustic should not be added to wash liquors in order to bring them up to strength as by so doing the optimum condition for subsequent precipitation of *beta* cellulose is thus provided.

In many plants weak washes from the mercerization department are stored and settled in properly designed tanks before use in the kiers. Precipitated solids settle out in properly designed bottoms from which they may be drawn off at appropriate intervals. While this system does not so definitely remove the dangerous substances as does hydrolysis, it is still a very practical method if the tanks are large enough and supervision rigid. Under conditions of ordinary work, no trouble results. Then comes a seasonal rush, usually in the spring. The dyer reports resists and blames the bleacher. The bleacher blames the water and the water, being inarticulate, has to take it. An analysis of such situations may disclose the fact that the settling tanks, quite large enough for normal production, were not equal to the peak load imposed upon them by a seasonal rush because the liquors were not left in them long enough to insure thorough settling. Freshet water may properly be blamed for many things but not for *beta* cellulose resists. Because it is so easy to confuse chronological sequence with cause and effect, it is unwise and often misleading to lay the blame for damage upon external conditions until a thorough study shall have lead to the assurance that internal methods have a clean bill of health.

The dangers outlined above, should, of course, never occur provided mercerization is done upon pure cotton cloth, insomuch as one of the objects of the kier boil is to completely remove all lower forms of cellulose. Bleached cotton should consist entirely of *alpha* cellulose. Because the boil does not always completely remove these lower forms of cellulose there always remains some danger that they may be dissolved during mercerization, although the danger is greatly minimized. Frequent routine tests of these washes should be made because a known industrial hazard may usually be avoided, while ignorance of a dangerous condition usually leads to expensive results.

Where mercerization is performed upon grey cloth, the situation becomes more complicated. Not only do the lower forms of cellulose dissolve but there is also a certain chemical effect upon the cotton impurities. This effect is inadequate for the removal of these impurities in any large quantity but it will be readily understood that sufficient contamination of caustic liquors may take place as to render subsequent use without purification unwise. The ingredients of warp size are all of such character as to be attacked by caustic soda solution of mercerizing strength but fortunately, and this is especially true in the case of starch, the short period required for mercerization does not provide the time element necessary for any considerable action by the alkali solution. Such starch as may be attacked is likely to become hydrolized to soluble products rather quickly under average working conditions. As these products accumulate, a dark brown color appears in solutions containing them. All wash liquors of such character should only be reused under careful supervision and with a most intelligent realization of the potential dangers contained in them.

While caustic soda has long been used for a variety of purposes in the dye house, the last few years have witnessed a considerable increase, which has been brought about by the employment of this chemical to dissolve vat colors. Fifteen years ago there were very few dye houses in which vat dyeing was carried out with uniformly successful results. Today all leading dyers are so familiar with the problems involved as to be able to turn out good work day after day.

The amounts of caustic soda required for the vatting of these dyes is considerable. In the case of all vat dyes it is important that the caustic used shall not be contaminated by outside impurities but this requirement becomes imperative in the case of those difficult to dissolve and apply. In many dye houses this fact is thoroughly appreciated and solid caustic, usually in flake form, is weighed out and supplied to the workman. As the caustic itself is of high quality, there is, in this case, little danger of contamination. All managers are not so careful, however, and it is quite common practice for dye houses to use "mill caustic" which is supplied from a common storage tank available for all purposes. This stock solution is supposedly maintained at a constant gravity and

(Continued on page 632)

Modern Printing of Textile Fabrics

By KARL M. HERSTEIN, F.A.I.C.
Consulting Chemist

It is not the intention in this article to repeat the numerous formulæ that are available in the literature or from any dyestuff manufacturer, but rather to illustrate the manner in which new chemicals, and types of dyes have been adapted with improved machinery to the demands of today.

THE art of printing textile fabrics is actually older than the knowledge of textiles. In Hawaii and other of the Pacific islands the natives did not know, at the time of their discovery, the arts of weaving or of knitting. However, they made a fairly efficient substitute for cloth from the inner bark of a tree which they stripped, flattened, pounded until soft and flexible, and cured. It was the custom to decorate this fabric with printed designs of reddish earth applied by means of an engraved block of wood. In the tombs of anicent Egypt will be found linens similarly decorated with printed designs of vegetable and mineral colors. In an art whose history thus covers a considerable part of humanity under civilization, it is natural that technique should not change significantly even with all the progress of modern invention. And such is actually the case. The general principles of textile printing are of almost immemorial age. They have adopted and adapted modern scientific developments and the art is still pretty much unchanged. Of course, the introduction of power machinery has multiplied production many times. Yet hand printing from blocks is still used. New developments of faster and more brilliant dyestuffs have improved the appearance and permanence of prints. New textile fibers have necessitated modifications of technique, but with all this, the old principles hold.

Printing differs from dyeing in that design is produced on the fabric by the local application or removal of color in printing, while in dyeing the application is general, and any design is either inherent in the fabric or is produced by manipulation such as "tie-dyeing" or "Batik."

In the art of printing paper it is recognized that color may be applied to the paper in three ways. The ink may be applied from a raised surface—"typography"; a treated flat surface—"lithography"; or a depressed surface—"intaglio." In the printing of fabrics, flat surface printing is not used. When the color is applied from a raised surface the operation is called "block printing" and is usually a hand operation but sometimes "relief printing" is done by machinery. Ordinarily when printing is mentioned, machine application of color from a depressed surface is meant. However, by taking advantage of the chemical properties of various groups of dyestuffs, three general styles of printing have been worked out; the direct style, the resist style, and the discharge style.

As has been indicated above, the direct style or the application of a colored design on a plain background, is the oldest of these, and was the only style practised until the modern coal tar industry developed. Once that had begun to reach its prime it was felt that new and desirable effects could be produced by the presence of colored designs on a background of different color. To some extent this was possible in the direct style. A black can be printed over any color. A deeper tone can be printed over a paler tint of the same color. But to secure true contrast in color, particularly with delicate colors, it is necessary that the ground color be absent where the design appears. It is not possible to do this successfully by blotch printing, that is, by printing all of the area except the design with the desired contrasting color. Even when the mechanical difficulties of even distribution and no spreading at the edges are overcome, there are troubles in penetration, solidity and evenness of shade which make the result inferior to that secured in the dyebath.

The first method used to secure this effect was to print onto the fabric a combination of materials which would resist the absorption of dye by the fiber from the dye bath. Usually, a combination of chemical and mechanical effects is used to obtain the proper result. Some substance can be found which will resist practically any dyestuff, and this is applied in a printing paste to the fabric, temporarily fixed, and the goods dyed. If desired, some other dyestuff which will not be affected by the resist is incorporated into the printing paste and a colored resist is obtained.

In both the resist and the discharge style of printing the whole goods are dyed. In the former the dye is prevented from coloring the imprinted portions and the goods are dyed after printing. In the discharge style the goods are dyed before printing and the ground color bleached out or "discharged" from the printed areas. As in the resist style, another color may be mixed into the discharge paste and the multicolored effect produced in this manner.

These general principles have been worked out completely for many years. In the past ten years it has become necessary to adapt them to the peculiar properties of the new artificial fibers. In the case of the regenerated cellulose rayons the difficulty has been very largely mechanical, while with the cellulose acetate rayons con-

sideration has been needed of the peculiar chemical and dyeing properties of cellulose acetate.

The distinction between dyeing and printing of textiles has been pointed out above. There is also a great similarity between the two methods of coloring fabrics in that in both arts color is applied to and fixed on the fabric. The mode of application differs, but the fixing must necessarily be the same. Hence we find mordant colors, azo, direct, vat and in fact almost all the dye colors are usable in printing. In addition, it was formerly the practice to use pigment colors in printing with the addition of a binder such as albumen, which was soluble when applied and then could be rendered insoluble by some special treatment. This particular style has become more or less obsolete with the new ranges of colors.

White Discharge on Vat Dyed Rayon.

The first group of "aniline" colors available was the basic dyes. Even today they are unsurpassed in brilliance of tone and range of shade. The basic dyes require to be applied with a mordant. It is possible to mordant the entire fabric, print, age to combine dye and mordant, and then remove the mordant from the unprinted areas. However, it would be simpler if the mordant (usually tannic acid with or without antimony) could be combined in the printing paste. The preliminary mordanting and the final removal could then be eliminated. It was found that a volatile acid such as acetic acid would prevent the combination of color and mordant to form an insoluble lake in the printing paste. After printing, a treatment with steam would evaporate the acid, and the lake was formed in the fiber. More recently, there have been available solvents which will keep the lake in solution in the paste until after the ageing. Some of these are old materials put to new uses, such as resorcin (A. Schneevoight, Am. Dyest. Rep. XV, 504). He suggests the use of 3-6% of resorcin in the paste for this purpose. Phenol and Aniline Oil are also in common use for this purpose. On the other hand there is a long list of solvents which have only recently become commercially available and whose

Direct Print with Acid Color on Silk Chiffon.

solvent properties are extraordinary. Many of these are esters or ethers of ethylene glycol. For instance, ethylene glycol itself, ethylene chlorhydrin, cellosolve, methyl cellosolve, and many others are recommended for this purpose.

Some of these compounds serve to replace the glycerine which formerly kept the goods moist in the ager during the whole time that fixation of the color took place. It can hardly be over-emphasized that today one can go into the market with a specification for solvent power, volatility, solubility in water, etc., and come out with a product exactly fitted to the need.

Then we have the suggested replacement of the old tannic acid with new synthetic mordants. (Am. Dyest. Rep., XVI 541). A paste is prepared by mixing a solution of a basic dye with the thickener, adding caustic soda in sufficient quantity to liberate the color base and a slight excess, possibly some hydrosulphite to take advantage of the greater solubility of the leuco base; then a mordant of the type produced by fusion of a phenol or amine with alkali sulphides; sometimes soap is added to brighten and deepen the color. After printing, rest and dry the goods for 12-24 hours, steam, treat with acetic acid and potassium bichromate, soap, and rinse.

There have been few changes in the application of direct colors in printing. These colors are still used in large quantity where this, rather than quality of result is the main desideratum. The choice in the field of direct colors is wide and should be exercised freely to secure such other results as may be needed. Fastness to light and crocking as well as dischargeability can be used as guides. However, one cannot expect from these comparatively cheap colors the fastness to washing and chlorine which can be gotten in the newer colors. Of these, the Naphthols and the Rapid Fast colors merit consideration. They approach the vat colors in fastness and in some parts of the spec-

(Continued on page 631)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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CALENDAR OF COMING EVENTS

Annual Meeting, Greensboro, S. C., Dec. 2 and 3.

* * *

Meeting, Rhode Island Section, October 28.

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Meeting, New York Section, Oct. 28.

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Meeting, Philadelphia Section, November 18.

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Meeting, Council and Research Committee, New York, November 4.

NOMINATIONS FOR OFFICERS

American Association of Textile Chemists and Colorists, 1933

Since publishing the list of nominations for National Officers for 1933, the Nominating Committee has received word from Mr. P. J. Wood that he is unable to run for the Presidency. The committee therefore, withdraws Mr. Wood's name and submits the name of Dr. Robert E. Rose, Director of Technical Laboratory, E. I. duPont de Nemours & Co., Inc., Wilmington, Delaware.

For the Nominating Committee,
A. Newton Graves,
Secretary

SPECIAL COUNCIL MEETING

A Special Meeting of the Council of the American Association of Textile Chemists and Colorists was held at the Providence Biltmore Hotel, Providence, R. I., October 8, 1932, at 2:00 P. M.

The following were present:

President: P. J. Wood.

Vice-Presidents: Wm. H. Cady, Alex. Morrison.

Councilors: Hugh Christison, Ralph F. Culver, Wm. R. Moorhouse, George A. Moran, Walter M. Scott.

Councilors ex-officio: Prof. L. A. Olney, Chairman, Research Committee.

Leverett N. Putnam, Chairman, N. N. E. Section.

Secretary: A. Newton Graves.

Letters expressing regrets at inability to attend were received from Elvin H. Killheffer and Henry F. Herrmann.

Upon a motion made and seconded it was voted that the following resolution be adopted:

WHEREAS, The American Association of Textile Chemists and Colorists has suffered the loss of one of its Charter Members and Officers through the death of Harry R. Davies, who since its inception had been one of the Association's most loyal supporters, and for the past three years its Treasurer, and

WHEREAS, Mr. Davies because of his genial personality, his courtesy and friendliness, and his willingness to help on all occasions, had won an enviable place in the hearts of the officers and members of the Association, be it

RESOLVED, That we the members of the Council of the American Association of Textile Chemists and Colorists do hereby express our appreciation of the many and untiring services which he rendered to our Association, and also our most profound sorrow in the loss of so valued a friend and associate and be it further

RESOLVED, That this resolution be spread in full upon the records of the Association, and that a copy be forwarded to Mr. Davies' family as an expression of our sympathy in their bereavement.

It was voted that Wm. R. Moorhouse be appointed Treasurer to serve until the Annual Meeting.

Upon a motion made and seconded it was voted to accept Mr. Moorhouse's resignation as Councilor to take effect immediately.

Respectfully submitted,

A. NEWTON GRAVES,
Secretary

MEETING, PHILADELPHIA SECTION

The 1932-1933 season of the Philadelphia Section was inaugurated on Friday, September 30th, at the home of the German Technical Society, 2315 North Broad Street, Philadelphia.

Our guest speaker for the evening was Professor Dr. Hugo Kauffmann, who presented a prepared paper describing "The Latest Research Work on Cotton Bleaching."

Dr. Kauffmann, who is in the U. S. A., for a very brief visit, is director of the chemical department of the Reutlinger Textile School, Germany, and professor of chemistry in the Technical High School in Stuttgart, Germany.

He is the author of a number of books relative to and a recognized authority regarding the practical application of chemistry in the textile industry.

His address was acclaimed very interesting and was followed by a lengthy discussion.

The business meeting was followed by the usual informal dinner and adjourned at ten o'clock P. M., after which round table discussion was in order.

The dinner attendance was 50 and the business meeting 67.

A copy of Dr. Kauffmann's address will be published very shortly.

Respectfully submitted,

CHARLES A. SEIBERT,
Secretary

RAYON SUB-COMMITTEE MEETING

On Friday, October 7th, the Rayon Sub-Committee held its Sixth Meeting in the rooms of the Chemists' Club, New York City.

The Committee unanimously agreed to submit to the Research Committee a group of nine rayon research problems which, at the discretion of the Research Committee, may be submitted to the Textile Foundation for the consideration of men applying for fellowships dealing with rayon. The individual members of the Committee expressed their willingness to cooperate with Research Fellows of the Textile Foundation, rendering technical aid and guidance throughout the course of the work, if requested.

The Research problems chosen were:

1. Determination of the Stress-Strain-Time-Temperature-Humidity Relationships.
2. Determination of the Density or Specific Gravity of Rayon.
3. A Study of the Existing Methods of Determining the Effect of Abrasion on Rayon and the Evolution of New or Improved Methods of Measuring the Effect of Abrasion on Rayon Filaments.
4. Determination of the Resistance of Rayon to
   a. Flexing.
   b. Compression.
   c. Torques.
5. Resistance of Rayon to Acids and Alkalis—Limits.
6. Determination of the Degree of Gloss or Luster of Rayon.
7. Means of Accurately Measuring the Shrinkage of Rayon.
8. "Micro-Analysis."
9. Development of Equipment and Technique of Studying Rayon During Manufacturing Operations.

SEPTEMBER MEETING, NEW YORK SECTION

THE first meeting of the New York Section of the American Association of Textile Chemists and Colorists convened at eight-five P. M., Friday, September 23, 1932, at the Chemists' Club, 52 East 41st Street, New York City. Mr. Henry F. Herrmann, Chairman of the Section, presiding.

Chairman Herrmann: Gentlemen, as we commence this, the first meeting of the 1932-1933 season I wish, first, to take the opportunity of expressing my pleasure at seeing such a generous representation here. It is only as we recall the frequency with which we come from one first

meeting of the year to another that we realize how time is slipping. The "bunch" seems to be about the same; as I look at familiar faces they all look just a little more attractive, a little more prosperous, perhaps here and there a gray hair that wasn't there before, possibly here and there a hair missing that used to be there. (Laughter.) At any rate, with the upturn of business—and I hope all of you gentlemen have had occasion to notice it—I hope that we will also have before us a very successful, a very prosperous and a very profitable year.

Naturally, we have no funds to prosper with but there is a lot of benefit that I thoroughly believe we can get out of these meetings. I have said this so often that I really don't like to repeat it again but even as the minister has to repeat a sermon in order to drive it home, I want to say again this is your meeting. It is your Association. It doesn't belong to the officers. It doesn't belong to the committeemen. You will get out of it what you put into it. Bearing in mind that this is probably the only place where all of us can get together and meet the men of our craft, the men of our own interests, the men who speak our language, it is fitting that we should get together once a month and talk our own language and understand one another.

We will now proceed with the regular business meeting. . . . The routine business of the Section was transacted . . .

Chairman Herrmann: We are fortunate in having the privilege of opening our year with a subject that hasn't received any attention at all heretofore, that is, officially, on the part of this Section. I don't know why. Possibly many of us haven't realized that refrigeration is a problem that modern engineering has introduced into textile practice. I therefore anticipate with great pleasure the talk of Mr. D. H. Jackson, whom I now take pleasure in introducing to you.

Mr. Jackson! (Applause.)

Vacuum Refrigeration for the Textile Industry*

By **D. H. JACKSON**
Croll-Reynolds Co.

THE subject that this discussion will deal with is one that the development department of the Croll-Reynolds Company has investigated for about five or six years. It had previously been a matter of considerable interest among engineers, for a long time.

The application of it to the textile industry, I think, is fairly broad and I should like to say for the benefit of those engineers who do not require refrigeration in their particular process work that we will deal in this discussion with the subject of heat recovery as well as refrigeration.

We might paraphrase the title of this discussion a bit by calling it, "Some Cold Facts on Methods of Producing Cold Water," and those that are not interested in cold water will probably have their patience rewarded by some comments on hot water a bit later, possibly hot air.

The subject of vacuum refrigeration is one that has attracted the attention of engineers in a great many process industries. It has already been successfully applied on a commercial basis in the textile industry which some of you gentlemen know about, and the results of this preliminary work and the initial industrial installation have been so successful that others have requested information and this discussion will cover briefly some of the important points of the system.

The requirements of the textile industry for refrigeration are somewhat out of the ordinary range of temperatures offered by mechanical refrigerating apparatus. The conventional refrigerating equipment has always provided temperatures down below freezing. The tin-weighting process, some of the mercerizing processes and others that you gentlemen know all about require temperatures below the temperature range of average water supply, at least in the summertime. They don't require freezing. The refrigeration industry has been developed for freezing temperatures, and lower. Those that need intermediate temperatures have been compelled to use equipment which was developed for the freezing temperatures and below. If you apply that type of equipment for intermediate cooling requirements it is somewhat similar to firing up a boiler to 100 pounds pressure when you only need 50.

The progress of refrigeration has brought out many remarkable developments in mechanical refrigeration and this new system of vacuum refrigeration has come at a very opportune time when the public is realizing more than ever before the industrial, social and economic benefits of air conditioning. I mention that merely because big public demand has stimulated this development which brings to the textile industry low cost refrigeration which they could never hope to have if it was not for the mere chance that demand for air conditioning had stimulated

* Presented at meeting, New York Section, September 23.

engineers, capitalists and equipment manufacturers to go through big expense to develop the system.

The principle of vacuum refrigeration is quite old. It is only the successful commercial application which is new. We can explain it, I think, very briefly and very simply.

Everyone has seen in the old ice plant and other industrial plants the cooling tower or spray pond where cooling of water is effected by spraying the water through ordinary atmosphere. That is a very simple and economical method of cooling. That particular process takes advantage of partial pressure of the water vapor in the air and permits cooling of water through ten or fifteen degrees of Fahrenheit. That cooling range is often useful but it is not sufficient for the requirements of tin-weighting and some of the other low temperature work in the textile industry.

The vacuum refrigerating system goes one step beyond the old simple cooling tower. Instead of spraying the water in the atmosphere the vacuum cooling system provides a vacuum chamber and the water is sprayed into a vacuum where the pressure is lower. A little more of the water evaporates than would be the case in the atmosphere, and you get the required low temperature without the elaborate equipment which is required for the conventional mechanical refrigerating apparatus.

If I may interrupt for a minute, I want to show a small chart of this system. (Showing chart.) Instead of spraying the water in the spray pond or cooling tower, we pass that water into the vacuum chamber. It may be 80 degrees Fahrenheit or any average temperature, or even above or below the average. The water enters through a series of spray nozzles into the horizontal vacuum tank.

I said a minute ago that the principle of this very simple cooling system is old. When we realize that you can cool water down to 40 degrees with absolutely no moving parts, we wonder why it was not done many years ago. It was tried many years ago but it was not successfully done, the reason being that when this water is sprayed into vacuum it immediately expands its volume at a tremendous rate.

I didn't measure this room but just from a rough calculation—if anyone has a slide rule in his pocket it might be interesting to check up but I don't think there will be more than 10 per cent discrepancy—I would say that if we take a gallon of water, evaporate it in a closed space and apply a vacuum of .25 inches of mercury absolute, or in other words, a vacuum of 29.75, referring to a 30-inch barometer, that one gallon of water would fill this entire room.

That is the reason this very simple cooling system has not been applied before. In order to do that cooling, that very large volume of vapor must be handled. It was tried fifty years ago. Mechanical vacuum pumps were used and engineers with vision thought that they had made big improvements in cooling processes, but the vacuum pumps couldn't handle the huge volume of vapor. If a gallon of water would fill up a room with several thousand cubic feet of space, one vacuum pump wouldn't be enough. Twenty or thirty working in parallel would be needed.

So the idea was dropped as being impossible. The results were too good to be true. And that condition remained the same for many years. The current interest in air conditioning and the cold water necessary for air conditioning stimulated a revival of this vacuum cooling system to the point where it was again tried by half a dozen firms, including Croll-Reynolds, and a large amount

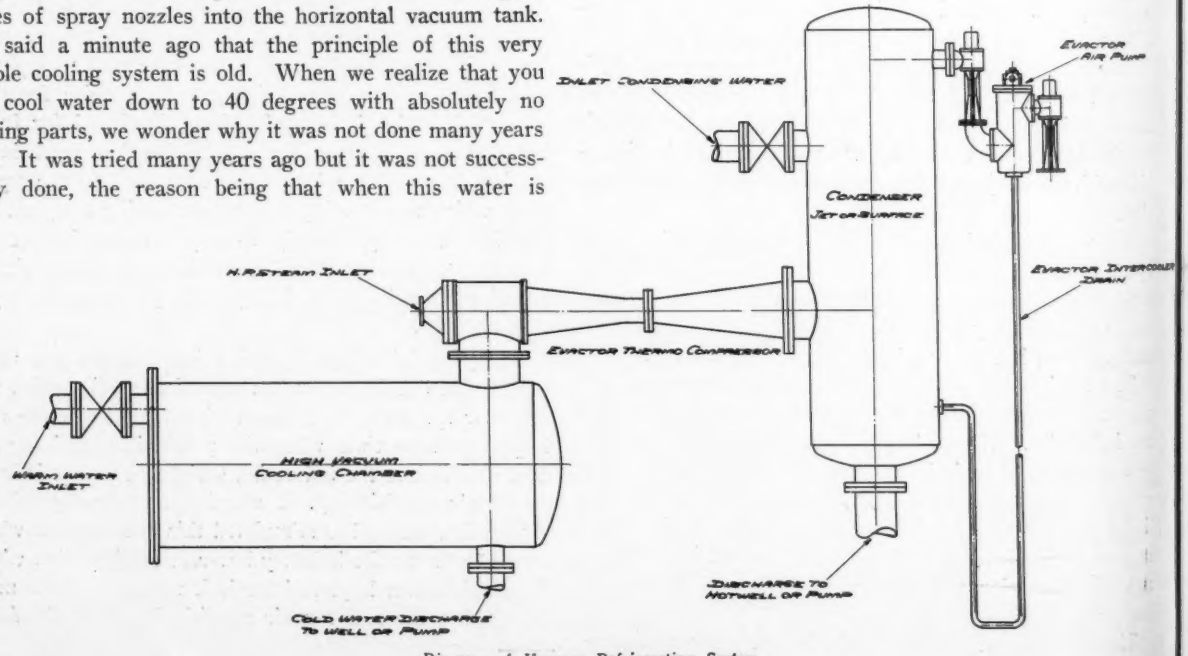

Diagram of Vacuum Refrigerating System.

of experimental work has been done, and it was found that the mechanical vacuum pump which was entirely incapable of handling this huge volume of vapor could be replaced very effectively with a simple steam jet equipment.

The velocity of steam at suitable pressure passing through small orifices or jets averages about 4,000 feet per second which is approximately the speed of a bullet. That high velocity solves the problem instantly. It is impossible for the old-fashioned mechanical vacuum pump to move with anything approaching that speed. When it was found that twenty or thirty vacuum pumps were required, it was thought to be hopeless. But with a very simple steam orifice, or nozzle, with high pressure steam blowing through it, the suction created by the velocity of that steam was measured, and it was found that that vapor was pulled through there at a high velocity that made the whole system more simple than any engineer had ever expected.

Continuing with the diagram, the water is sprayed into the high vacuum. The steam jets create a suction in the Venturi throat, which pulls the vapors through at a high velocity. As the vapor goes through, more water is cooled, so that the process is continuous. A definite flow of water is maintained in the vacuum chamber. A definite ratio of it is evaporated. That ratio incidentally is very small. Evaporation of three per cent volume of water passing into the cooling chamber produces a cooling effect of 25 degrees. You can take water from the city mains at 70 degrees Fahrenheit, evaporate only 3 per cent of it and cool it to 45, which will serve many of the requirements of tin-weighting and other textile processes very effectively. If lower temperature is required, the vacuum is raised a little by using more steam. You can cool as low as 35 degrees Fahrenheit and lower if necessary, although this is about the practical limit of the system as the steam cost becomes excessive when operated below 35° F.

That water is cooled directly by a simple application of vacuum. It requires absolutely no moving parts in the apparatus which is one of the big improvements in this system over other methods of refrigeration. The conventional refrigerating equipment uses ammonia, methyl chloride, carbon dioxide and other refrigerants. All must be compressed at high pressures and then expanded to produce a cooling effect. The compression of those refrigerants means reciprocating or rotary pumps with valves, pistons, and other moving parts, which wear out and cause trouble. Nothing moves in this system other than the water and the steam itself. The system is relatively new. It might be claimed that one could not say it would last ten years or twenty years because it has only been available for two years, possibly six years in the laboratory and experimental shop, but exactly the same steam jets that do this cooling have been working on vegetable oils that go into our mayonnaise, have been working on glycerin that goes into our soap and other industrial products, and it is known that that type of equipment has practically no maintenance expense. Once it is installed it is there and no moving parts mean that no repairs are necessary, and the advantages of the system are equally good after any indefinite period.

While the system in this form has been in use as long as five or six years in development work, its individual parts have all been used very generally and successfully for several decades and are known to be free from maintenance expense. It is just a matter of combining these well known integral parts, and those mechanical engineers that are here are probably wondering why nobody ever put the three of them together before—a simple vacuum cooling chamber, a high capacity steam jet, and a condenser. We could have had this economical cooling system fifty years ago that is now creating quite a sensation even in these thin days of 1932.

I want to mention relative operating costs of this equipment compared to mechanical refrigeration which is now the accepted and conventional method of cooling tin-weighting baths and other process operations in textile finishing.

The engineering department of the firm I represent has collected data on this subject from outside sources. This has been correlated with data that they have themselves accumulated over a period of years and the relative operating costs of this system over the other possible systems available are interesting.

We will start first with an ordinary cake of ice. A great deal of cooling has been done with ice. I may show my ignorance by speaking of cooling tin-weighting baths with ice but, after all, our organization consists of equipment manufacturers rather than textile colorists. But this matter of cooling that water required for necessary low temperatures in that work and in other work requiring intermediate temperatures has been studied very carefully and the operating costs, of course, vary in different cases.

Getting back to our cake of ice, we will assume an average cost of ice of $5 a ton. Many of the textile plants use a cooling capacity varying from 10 tons all the way up to 50 tons. I know of one big plant that is now using this system where a capacity of 80 tons of refrigeration is required. That is probably the largest in its field.

So we will take an average of 25 tons of refrigeration for 24 hours. With ice at $5 per ton that is close to $5 an hour. If you figure 25 tons for 24 hours, that is close enough for our purpose.

If we pass to the mechanical refrigeration based on an ammonia compressor, we find that the principal item of operating cost is an electric motor. The 25-ton unit uses motor horsepower varying between 35 and 40. The cost of electric current varies possibly between one and two and a half cents per kilowatt hour. On that basis, an average figure for running the 25-ton mechanical refrigerating unit would be about 40 cents an hour. That is a small amount, compared to ice. That is the power cost alone. If you can do it for 40 cents an hour with ammonia and need $5 an hour with ice, no one will do it with ice, except possibly in the experimental stage.

Those are two of the cases. Now we pass to the vacuum cooling system. No electric motor is required to drive the system. Steam only is used in creating the vacuum necessary for cooling.

I understand that various plants which you textile men operate have boilers. The steam required for this system is a very small part of the total steam you need in the plant, and if you figure on a very conservative basis and charge this steam entirely to refrigeration, for a 25-ton unit it will figure about 40 cents an hour which is exactly the same as the ammonia machine.

That makes it sound as though the two are on a par for operating expense, but we look further and find that the steam that we blow into this cooling chamber all passes through a Venturi throat over into a barometric condenser C. It may also be a surface condenser, if there are special conditions. Every bit of the latent heat of that steam plus some of the sensible heat plus the heat from the water sprayed into the cooling chamber is recovered by the condenser water. That condenser water leaves there about 15 degrees warmer than the temperature at which it enters. This condenser water then can be run into a storage tank or into a final heater and every bit of the heat used in this system can then be applied to the high temperature finishing processes operated in all textile plants.

So on that basis the cost of this system is relatively nothing. The present method of heating the average dye bath is to insert a steam hose and let the steam bubble in the bottom. The energy of the steam is wasted. The heat of the steam of course is used. This system just takes some of the steam that you would otherwise blow into your high temperature dye bath, uses the energy of that steam for generating cold water, and saves all the heat of the steam plus the heat taken out of your tin-weighting bath and your mercerizing bath. All that heat can be recovered.

From cooling, we are gradually getting to heating of water. A by-product of this cooling system is warm water. That might lead further into a discussion of recovering heat from the waste dye liquor which every finishing plant throws out in large quantities.

We have worked with a number of textile engineers. A great many of them have admitted that the heat they throw away in steaming liquids which contain spent dye liquor is equivalent to anywhere from one to ten tons of coal per day. The textile chemist and colorist has been busy improving his product, extending the scope of his activity, giving more and better textiles to the world, and has accomplished so much in the line of chemistry and technical improvements in his art that the mechanical features of heat recovery have been somewhat neglected. The heat that is thrown away in a $100,000 textile plant would be considered a disgrace in a power plant that is operating with 100 times as much coal per day, where the loss, in proportion, is only one per cent. Yet the mechanical engineers in our modern utility plants have specialized on heat recovery to the point where they recover pennies, where textile men are wasting dollars.

If that sounds too critical, we would only suggest actual measurement of the temperatures and quantities of liquid, followed by simple calculations of methods of recovering that heat.

So I will close this discussion with the comment that a new system is available whereby the cooling cost is reduced on an average of 60 per cent. The investment cost of this equipment is an average of one-half the cost of mechanical refrigeration. The maintenance cost is even more favorable. The operating cost, at the worst, under the very worst condition, is equal to mechanical refrigeration. By connecting this system with a hot water system the operating cost is substantially zero. The saving of this 15 degrees of temperature here should be one step toward recovery of heat that is now being thrown into the sewer in the waste dye liquor.

Thank you. (Applause)

Discussion

Chairman Herrmann: Mr. Jackson has very kindly consented to answer any questions that may occur to any of you gentlemen. To me, it seems something to contemplate the tremendous heat losses that are thrown away daily in the form of spent liquors. I suppose it is something that has seldom if ever occurred to the average person who thinks he thinks. And it is for reasons such as these that I think it is very useful that once in awhile we invite an engineer here, because he works with slide rules and thermometers and is about as economical as the Scotchman when it comes to saving pennies.

Gentlemen, there must be many of you to whom this subject is very interesting and if you have any questions I am sure Mr. Jackson will be glad to answer them. Just let's have them as informally as you care to make them.

Mr. Louis S. Zisman: I should like to ask Mr. Jackson as to whether much work has been done in developing equipment, basing it on this principle of recovering heat.

I mean, has that been gone into practically, or are you developing such equipment at the present time?

Mr. Jackson: Do you refer to heat recovery from the waste dye liquor or to refrigerating equipment?

Mr. Zisman: To heat recovery from the waste dye liquor only.

Mr. Jackson: Yes, that has been developed and applied on a commercial scale over a period of years. Croll-Reynolds' organization that I happen to be connected with has installed some equipment for that purpose in Paterson and other points for recovering heat from waste dye liquor. That of course is different from the question of vacuum cooling, as mentioned in the discussion. Of course, the two tie in together to some extent.

The heat used in generating this cooling effect is available as a by-product for heating the fresh dye bath. The equipment for recovering heat from the spent dye liquor is not illustrated here. There is some literature available, if anyone wants it, on equipment that has been developed for recovering that heat from the spent dye liquor, and commercial installations have been made in several finishing plants.

Dr. Jos. F. X. Harold: I should like to ask Mr. Jackson just how the mercerizing liquor or the tin liquors contact this cooling chamber and just what is the modus operandi by which the heat transfer takes place between the liquors that are to be chilled and this device.

Mr. Jackson: We were a little bit narrow-minded probably in limiting the discussion to the apparatus itself. The application of it to textile finishing processes, which Dr. Harold has brought out, is an important point.

The water sprays in the vacuum chamber, collects in the bottom of the chamber, and is drawn out by a small circulating pump, or by a barometric leg. By mounting the equipment at a suitable elevation, the pumping load in that cold water line is no more than it would be on the cold water circulated from mechanical refrigerating units. But, answering Dr. Harold's question, the cold water passes out through a very small pump with about a half horsepower motor. It is then circulated through coils in the tin-weighting bath or the mercerizing bath. These coils according to general practice of mechanical refrigeration are copper or steel coils covered with rubber, the rubber covering being necessary to resist the action of corrosive salts and acids in the tin-weighting solution.

Chairman Herrmann: Are there any more questions?

Dr. Chute: If you will allow a "ringer in" to speak, I should like to say that as I understand it the question that was asked was how you contacted the cold water so as to cool off the mercerizing bath. I believe there is nothing but caustic soda in the mercerizing bath, and I should like to ask, is there any reason why you couldn't spray the mercerizing bath directly in your chamber and cool it down? It is used in iron, anyway, isn't it? So that there is no reason for anything corroding the mercerizing bath. So that the mercerizing bath could be sprayed in, instead of the waer, if you wanted to use a mercerizing bath. With tin-weighting solution that is probably a horse of another color.

Mr. Jackson: I thank Dr. Chute for that comment.

The coil I spoke of is a rubber covered coil, the general practice of a tin-weighting bath. The mercerizing bath makes a simpler problem in that it can be sprayed direct in the cooling chamber, if you care to do it that way. If the mercerizing bath must remain at low temperature, the coils probably will also be necessary. I am probably not enough of a textile man to elaborate on that point.

Chairman Herrmann: I should like to say that that is a very interesting engineering problem, whether you spray the water or spray the mercerizing liquor. We at least are sure that it is going to be cooled. I suppose there are so many liquors that interest us in our textile processes that it would probably be rather complicated if we wanted to treat each one differently and, personally, the cooling coil sort of appeals to me. It is simple enough, anyway.

If there are no further questions I should like to call on our next guest of the evening who is going to speak to us on, "Properties of the Acele Yarns in Regard to Dyeing and Finishing."

It gives me great pleasure to introduce Mr. C. F. Chandler of the Acele Department of the duPont Company. Mr. Chandler! (Applause)

Mr. C. F. Chandler: Mr. Chairman, Fellow-Members, Gentlemen: It seems to me Mr. Jackson has given us all something to think about. I can add another problem in connection with heat recovery. He talked about dyestuff liquors. How about recovering some of the dyestuff itself, particularly some of these dyestuff liquors that go out in the sewer where you have been dyeing Acele?

. . . Mr. Chandler then presented his prepared paper. . . . (Applause)

(*Mr. Chandler's paper will appear in the next issue of the* REPORTER.)

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STANDARD SILK SAMPLES

There have been prepared, under the direction of the Sub-Committee on Fastness of Dyed Silk, standard dyed silk fabrics to represent four classes of fastness to washing—namely, Class I, Class II, Class III and Class IV. These standards have been carefully dyed with the dyestuffs and according to the dyeing methods recommended in the 1931 Year Book.

The A. A. T. C. C. is prepared to furnish sets of these washing standards for a nominal charge which will cover the cost of preparation. It will be possible to accurately grade the fastness to washing of any dyed silk fabric by comparing it with the standards after subjection to the standard washing tests approved by this Association. All inquiries concerning these Silk Washing Standards may be addressed to the Chairman of the Research Committee,

Louis A. Olney,
Lowell Textile Institute,
Lowell, Massachusetts.

AMERICAN DYESTUFF REPORTER

Devoted to the Interests of Textile Chemistry, Bleaching, Dyeing, Finishing and Printing.

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THE LAUNDRYOWNERS AND QUALITY

THAT the Laundryowners National Association is behind any movement for quality in the textile field is evidenced in a report given by George H. Johnson of the Department of Research at the 49th Annual Convention of the Association held last week in Toronto. It will be recalled that some time ago Mr. Johnson presented a paper before the New York Section of the American Association of Textile Chemists and Colorists on "The Laundryowners' Problems in Relation to the Dyer and Finisher." (Published in this journal, Page 654, October 12th, 1931.) Much of what he said then is reiterated in his present report.

There is a close tie-up between the work of the dyer and the laundryowner. This is particularly well brought out in that section of the report devoted to fast colors. The report states that for years commercial laundries have been urging their customers to insist upon fast dyed and printed wash goods at the time of purchase. It goes on to state that two facts have been emphasized at every opportunity. The first of these is: "Color fastness depends upon the choice of dyestuffs and not upon the laundering process that is used." Dyers probably will not agree with this statement in its entirety. It is true that if a fast dye and a fugitive dye are given the same laundering treatment the qualities of the fast dye are readily shown up to advantage. Perhaps it would be more to the point to modify the latter part of the sentence to read "providing a suitable method of laundering is used." Essentially, of course, the color fastness of a fabric depends upon the choice of dyestuff. The importance of the statement lies in the fact that fast dyes are advocated. Consumer reaction, as reflected through this association and others, will eventually demand fast dyes. This leads up to the second fact: "Consumers must demand fast colored wash materials if they really want them." To this we can only add the timeworn statement that consumers will get what they pay for—no more, no less. The fact that competition based on quality rather than price is rapidly becoming more important as people are becoming satiated with poor merchandise, will increase the demand for quality fabrics and put the textile industry back on a paying basis.

To revert again to the text of the report let us quote a bit:

"Fortunately a number of converters and retailers have seen the danger signal and are still stressing fast vat and naphthol colors. Thus we find, for instance, one prominent dyestuff manufacturer in its advertising matter featuring the necessity for choosing the fastest colors possible and quoting retail executives' opinions on the subject of color fastness. The following potent phrases express the viewpoint of the leading retail establishments of the United States with regard to color fastness:

"1. 'Fast color in wash fabrics is of prime importance to us'—Carson Pirie Scott & Co., Chicago, Illinois.

"2. 'Wash fabrics must be fast. It would be the height of business folly to have them otherwise'—Marshall Field & Co., Chicago, Illinois.

"3. 'Demand for washable, sun fast color fabrics is so great we stock no other kind'—William Hengerer Co., Buffalo, N. Y.

"4. 'Fast color in wash fabrics is taken for granted by our clientele'—Joseph Horne Co., Pittsburgh, Penna."

If, as is only logical, we take the retailers' demand as reflecting the demand of the consumer, then we can readily see that the public wants fast colors.

The next section of the report, more of interest to the finisher than the dyer, is given over to shrinkage. This subject is dimissed with mention of three commercial processes that are used to pre-treat fabrics to prevent future shrinkage. The point is brought out that for colored garments to give the consumer the utmost satisfaction not only must they be tailored from materials that have been dyed or printed with the fastest available colors, but also they should be constructed of fabrics which have been pre-shrunk by a satisfactory method prior to cutting up. Pre-shrinkage processes are comparatively new in their commercial development but undoubtedly fabrics guaranteed against shrinkage will be the only ones to meet popular demand in the future.

A problem akin to shrinkage receives attention in the next portion of the report. This deals with overstretching, as applied in the rayon trade, and also temporary weighting. These practices were in vogue especially during the latter part of 1931 and the early part of 1932. These practices attained considerable publicity and nothing that the reader does not already know can be added here. The results were exactly what were to be expected. Consumer complaints were numerous. The rayon manufacturers warned the retailers not to stock up with rayon

merchandise that could not give satisfaction to the purchaser. We coincide with the report in the hope "that these warnings, plus the publicity that has been given to overstretching and weighting of rayon knit tubing, will have a corrective influence upon a manufacturing and sales policy that is suicidal, to say the least, if it continues."

With the increased popularity of summer wash suits in the East and Middle West as well as in the South another important problem confronted the laundryowners. A special report of the L. N. A. was released on this subject. Wash suit shrinkage was given special consideration. It was brought to the attention of all concerned that the natural shrinkage or contraction of wash materials that occurs during washing cannot be eliminated by controlling the wash suds or temperature. The shrinkage depends upon the fabric itself, and shrinkage can be reduced to a minimum in such cases only by proper preshrinking to begin with. The importance of proper pressing in order to fully develop volume business in this line was also brought out.

The report ends with an admonishment to laundryowners to watch the textile market carefully inasmuch as they are the ones who will be required to satisfactorily launder the materials that are being woven, dyed or printed, and finished in textile plants today.

So much for the report. In conclusion we wish to state that the attitude assumed by this Association in recommending and stressing quality rather than cheapness should receive the commendation and cooperation of allied associations and organizations. Let us hope that such ideas become prevalent.

Lowell Textile Alumni Meeting

A meeting of the New York Chapter of the Lowell Textile Institute was held at the Happiness Restaurant on Wednesday, Oct. 5th, at 6:30 P. M. Preceding the business meeting an informal dinner was held.

President Adolph J. Winkler presided over the business meeting, introducing as the speaker Sydney P. Munroe, '12, vice-president of the Cotton Textile Institute.

Mr. Munroe discussed the activities of the Institute bringing out the fact that through its activities the inventories of cotton mills were reduced approximately 45% since January 1st. He also emphasized the necessity of complete accord among the cotton men in order to equalize the ratio between production and consumption. A discussion was opened following Mr. Munroe's remarks.

A committee consisting of Harold Rubin, '21, C. W. Jessop, '22, and A. E. Davieau, '16, was appointed to make arrangements for the Lowell Textile-Upsala football game at East Orange on October 22nd.

Calco Moves Offices

The Calco Chemical Company, Inc., has announced the removal of its New York offices to 90 West Street, New York City.

American Cyanamid Outing

The fall golf outing and field day of the American Cyanamid & Chemical Corporation and its subsidiary corporations was held at Briarcliff Lodge Wednesday, October 12th. The day was devoted to golf, tennis, baseball, field and obstacle races, horse-shoe pitching, and aquatic events in the evening. Suitable prizes for winners in the different events were awarded. The attendance was increased by the presence of the district sales managers of the American Cyanamid & Chemical Corporation, who were in New York that week for the sales meeting of the corporation.

French Coal-Tar Imports Continue Increase

According to Assistant Trade Commissioner Earle C. Taylor, Paris, French imports of coal tar during the first five months of 1932 amounted to 81,905 metric tons, of which Great Britain supplied 39,263 tons, Belgium 10,893 tons, and Germany 5,430 tons. This is a considerable increase over total imports of 40,684 tons in the same period of 1931 and follows the increase in the year 1931 to 130,567 tons over the 95,177 tons received in 1930. During 1931 the United States supplied 8,976 tons compared to none in 1930 and it is believed that it accounts for a large part of the 1932 receipts listed under "other countries."

Textile and Tanning Chemicals, India

According to Consul Dayle C. McDonough, the bulk of tanning and textile chemicals consumed in India must be imported. About one-fourth of the trade in these products is in the Bombay area, which has 274 individual textile mills. In comparison, the tanning industry is small. Bichromates, sodium carbonate, alums, sodium sulphide, and borax, to the extent of 10,000 to 12,000 tons annually, are used around Bombay in these industries. The trend in this trade is illustrated by total imports into all India shown below for the last three years:

	1929-30	1930-31	1931-32
Alum	$113,460	$62,930	$56,780
Bichromate (soda)	72,580	98,410	91,620
Borax	76,940	57,420	76,700
Soda ash	2,559,200	2,522,670	1,976,280
All chemicals (all India)	10,034,500	9,404,100	8,223,120
All chemicals (Bombay)	2,563,800	2,339,600	(No data)

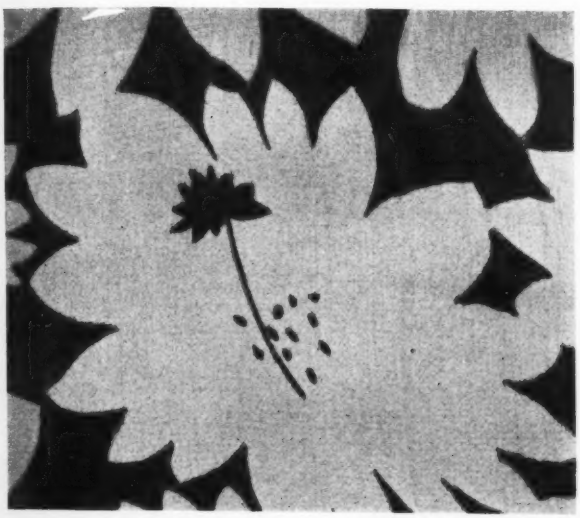
New Rayon Blue

The General Dyestuff Corporation releases Benzo Viscose Blue BF, a new member of their Benzo Viscose range, which is said to level well on rayon and eliminate bar effects. It is also said to surpass the older brands by a much clearer redder shade and increased tinctorial value.

Modern Printing of Textile Fabrics

(Continued from page 620)

trum equal or exceed them in brilliance and range of shade. In fact, they are often used together in one or another of the printing styles to produce very striking and beautiful effects.



Direct Print with Acid Colors on Silk Chiffon.

The Naphthols are simply a new line of azo colors in which the stability of the diazotized base has been improved so that the former necessities of cooling and speedy operation have been largely avoided. At about the same time as they appeared on the market the Rapid Fast colors were brought out. These, too, are azo dyestuffs, but they contain already mixed the naphthol and the diazotized base. This latter is combined as a nitrosamine and cannot couple until it is acidified. They are stable to and in fact are stabilized by alkali. For printing, the Rapid Fast colors are possibly preferable to the Naphthols. In the case of the latter it is necessary either to pad the whole cloth with naphthol and afterwards remove it from the unprinted areas, which is always wasteful to some degree, and may be quite expensive if there are considerable areas of white. On the other hand, if the design is printed with Naphthol and developed by passing the cloth through a solution of the diazotized base, other colors may be affected. In either case the difficulty may be avoided by the use of Rapid Fast colors directly in an alkaline printing paste. The printing is following by 3-5 minutes ageing and development either in a bath of acetic or formic acid or even in a vapor bath of acetic acid for goods which should not be washed. In using the Rapid Fast colors precautions must only be taken against premature development by exposure to acid or acid fumes, or exposure to reducing agents, since they are readily dischargeable. These general properties suggest a division of application such as the Naphthols for ground colors, the Rapid Fast colors for direct printing or an uncolored ground, and the Vat colors for either ground color or colored discharges.

Even newer than the Rapid Fast colors and the Rapidosols are the Rapidogens. These, too, are ready mixed diazo base and naphthol so stabilized that they will not couple to produce the dyestuff until treated with acid. Their peculiar feature is the ease with which they may be developed and fixed. All they need is a few minutes pass through an ager which is filled with the steam from boiling dilute acetic or formic acid. On account of this facility of application and their adaptability to combination with the Indigosols they have been adopted successfully by several printers.

It needs no restatement that when properly applied and selected the vat colors are the fastest colors available. In the past twenty years methods of using the new colors of this group in almost all styles of printing have been worked out. The earliest vat color, indigo, was used as a ground color in discharge styles long before any other application of vats to printing had been made. Its use in this manner depended on the fact that it can be destroyed by over-oxidation as well as bleached by reduction. Hence the older discharges on indigo were made by printing a paste of strong oxidants and steaming. This process was difficult to control as too little oxidant left the whites tinted, while too much might damage the fabric. On account of the ready oxidation of reduced indigo (indigowhite) a reduction discharge was impractical until the discovery of Leucotrope. This is a compound which instantly combines with and stabilizes the leuco derivatives of the indigoid group and makes their subsequent removal by washing possible. Hence a process of securing multiple color effects of the utmost fastness such as the following is entirely practicable.

First, print the white goods with a "copper-blue" reserve paste, dry, dye with an indanthrene color, and remove the paste by acidifying. Second, discharge print with a paste containing Rongalite CL (a combination of Hydrosulphite and Leucotrope) and another vat color of the Anthraquinone series, age for 5 minutes and wash with hot water and soap. This outline will indicate the

possibilities now open in the line of striking effects combined with permanence.

Of recent years a great improvement in the use of vat dyestuffs in printing has resulted from the discovery of the Indigosols. These present a selection of the vat colors in the form of stable, soluble leuco derivatives. Hence they may be applied to fabrics where formerly the vat colors were barred on account of the alkali needed with them. In use they are incorporated into a printing paste and then developed by a combination of acid and oxidant. For instance, the paste may contain either Sodium Chlorate or Nitrite and Ammonium Oxalate or Sulphocyanate, the former as oxidant and the latter as acid former. By steaming the print is developed. Or else after printing the Indigosol it is developed by passing through a bath containing Sulphuric Acid and Bichromate or Ferric Nitrate. The Indigosols may also be used as ground colors in discharge or resist printing.

Few major changes have been introduced into the printing of textiles by the new textile fibers. The regenerated cellulose rayons may be treated like cotton with only the extra precaution in handling required by their loss of strength when wet, and extra care in the selection of dyestuffs of good leveling properties. In this connection the writer recalls a few cases of "all rayon" voiles beautifully printed with a multicolor floral design on a dark ground where the effect was ruined by the slippage of a few overstretched warp yarns during the washing operations. With regard to the printing of Cellulose Acetate, Mullin (Text. Col. 49:460) says, "It is even more simple to print Acetate Silk than to dye it. . . . With minor exceptions it is possible to print almost every dyestuff onto Acetate Silk that is capable of dyeing it, and by the use of alkaline printing pastes to hydrolyze or saponify the fiber locally, many dyestuffs which are not successfully dyed upon this fiber give excellent results in printing." Naturally there is here implied a master printer whose judgment and knowledge can overcome any difficulties which may arise.

Many agents to increase the swelling of the fiber and its receptivity for the dye can be incorporated into the printing paste. Among these are acetic or lactic acid, resorcin, or some of the new solvents mentioned above. Ammonium thiocyanate in combination with the Dispersol or S.R.A. colors is very effective. In line with this subject of Cellulose Acetate there is the contrary suggestion (Chemicals, Dyestuffs Section XXVI, 35) to produce new effects by printing cotton with caustic with or without the addition of alcohol or with an alkali alcoholate and treating with an aromatic esterifying agent. This produces a reserve or resist to the direct dyestuffs but the resisted area is dyeable with gallocyanine derivatives or with certain acid dyestuffs. Other suggested processes similar to this are (Am. Dyest. Rep., XIV 792) to print a viscose solution onto cotton which it is stated produces a translucent effect of great interest and adds 20% to the strength of the fabric, or (Chemicals, Dyestuffs Section, XXVI:45) to print a solution of Cellulose Acetate in acetic acid with or without the addition of a pigment or dye. This is claimed to produce embossed embroidery-like effects.

In the introduction to this article it was stated that modern science had introduced no basic changes into the art of textile printing. However, it is hoped that enough has been cited to show how the minor and major improvements made possible by the progress of invention have opened new fields of great diversity of design and color combined with great resistance to deteriorating agents of all kinds.

The writer gratefully acknowledges the courtesy of Mr. P. J. Wood in furnishing material for illustrations.

Caustic Soda in the Finishing of Cotton Piece Goods

(Continued from page 618)

purity. In practice the gravity has been found to vary considerably so that the nice balance of vat formulæ, so necessary with certain colors, is overthrown and expensive dye is lost. Many dye house superintendents will take great care to maintain the purity of water used in their processes but will take for granted the integrity of a stock solution of caustic soda. In the application of expensive vat colors, nothing like this should be taken for granted, for impurities will cause a dulling of shades and in extreme cases blotchy dyeings.

Although the use of solid caustic is the safer procedure in the dyehouse, a stock solution may be used provided necessary precautions are taken. In such case it is preferable that a separate stock tank for the dye house should be maintained under the responsibility of the dye house superintendent. Into this tank nothing but water of dye house purity and solid caustic should ever be put. Gravity should be maintained scrupulously, giving due attention to the temperature at which hydrometer readings are made. Even when this is all done, care must be taken in the measuring out of the solution. Workmen have very vague ideas of what constitutes a quart or a half pail or even a full pail of caustic. As a matter of fact, it is far better to weigh out the solution than to measure it.

All this may appear to be highly theoretical and ultra scientific. It will be understood as highly practical, too, when the fact is appreciated that a clearing up of one of the points cited above resulted in an annual saving of more than $25,000.00 to one large corporation. Too long familiarity with the uses of caustic soda may breed a contempt for its properties. It should, however, never be forgotten in using this substance that it is one of the most active chemical bodies known; that, as a consequence, it tends to react with everything with which it comes in contact; that products of these reactions are often soluble in it and that only by a knowledge of its properties can safe and intelligent use and reuse be accomplished.

Abbott Dyeing Process

By **HENRY BARKER BURKE**

An outstanding system, developed under practical mill conditions, primarily for coloring worsted top and worsted or woolen yarns with sufficient uniformity to produce solid shade fabrics previously practical only through piece dyeing with notable reduction in costs over any previous method, now successfully extended to include all types of yarns, single or ply, cotton, rayon, or silk.

THE Abbott Process Dyeing equipment has within the year become the subject of considerable interested inquiry on the part of chemists, dyers and those executives whose manufacturing operations include dyeing in one form or another.

This equipment is by no means new and untried. It has been in a state of productive development under practical mill conditions for some ten years. Many large worsted plants have for the past three years, been enjoying the advantages that this system offers. In fact, equipment already in place for worsted top or slub dyeing and worsted yarn dyeing has a productive capacity of over 25,000,000 pounds yearly.

The development of the equipment was, as mentioned, brought about under practical conditions and with a view not only to keep down costs, but to eliminate the many evil features found in existing top and slub dyeing equipment.

The Abbott Process Dyeing equipment is more than a dyeing machine. It is a carefully worked out process with equipment designed to give the highest quality work at a minimum of expense.

The dyeing machine is in itself highly developed but can be considered but an integral part of the system. In short, the Abbott Machine Company (originators, patentees, and sole manufacturers) has given much consideration to the operations both preliminary and subsequent to the dyeing itself and has developed practical mechanical equipment for the entire process including winding, dyeing, drying, and also dyeing application processes, together with systematized methods of color-matching control, all of which have an important bearing upon the results obtained.

The dyeing was primarily adapted and perfected for worsted top or slubbing and further developments have now made possible the successful handling of yarns, either single or ply, worsteds, woolens, cottons, rayons, or silk.

The exactness of the coloring and the radical reduction in costs is such that for the first time, it is now possible to make solid shade fabrics from slub dyed yarns at a cost decidedly under the cost of producing the same fabric by piece dyeing methods. Many patterns of solid shades are being dyed in the yarn on the Abbott system with corresponding economies and with greatly expedited delivery. Solid shade velvet carpets and ground colors in difficult taupe shades have been colored in the yarn successfully on a production basis.

The top dyeing equipment comprises a specially designed Gill through which the top sliver in an untwisted form is wound under tension to a perforated metal dye spool. The uniformity and density of this package is such that no slumping takes place when the wound package is held in the dye solution or rinsing waters regardless of temperatures.

The dyeing is carried out on the perforated metal spools which are locked in place over an orifice in a specially designed dye kettle. These kettles are made for eighteen,

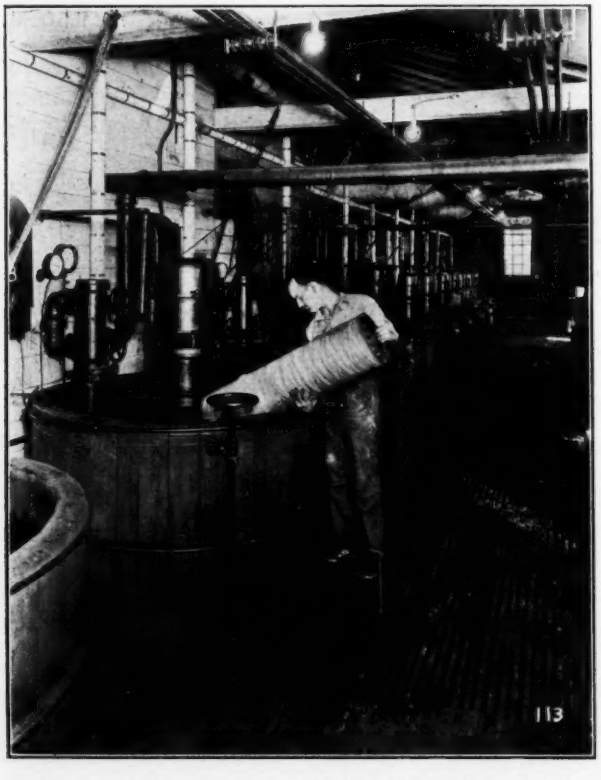
The Abbott Dye Kettle.
Showing Portion of Spools, Gauge, Controls, etc.

six or two spools and may dye less than full capacity with perfect results. The sliver is not disturbed in any way during the process and no slubs are produced. The circulation is positive and so balanced as to permit of uni-

form distribution and penetration. Even the lightest of shades and tints being dyed uniformly throughout the mass.

After dyeing the spool is washed in the kettle and then taken to the drier without extraction and dried at moderate temperatures. The drier accommodates from one to eighteen spools. The average time for drying fine top is just under two and one-half hours and less for coarse top or yarns. Backwashing is dispensed with entirely and even the heaviest shades are being dyed without crocking. From the drier, the top, still on the spool, is run from a six spool creel through a balling Gill and may then be drawn and spun directly without recombing or it may be made into mixtures direct from the spool.

In handling yarns, it is the practice to run them from an over-end creel at high speed to the dye spool, suitable devises for exact tension and yardage having been carefully perfected. No changes are necessary in the dyeing



A battery of Abbott Process Dyeing Machines—Loading the Dye Kettle.

or drying equipment to accommodate the system to yarn dyeing. Special rewinding machinery has likewise been perfected to rewind to filling bobbins, jackspools, or to any desired package form, cone or cheeses.

That the maker's of this equipment in its development in their own fine yarn mill were able upon its perfection to absorb all charges for designing, engineering, experimental and patent work and at the same time meet all competition on a profitable basis is perhaps the most eloquent endorsement of the substantial worth of the equipment. The added endorsement through its complete adoption by the larger users immediately upon its being offered for sale further validates all claims of performance and economical low cost production.

In summary, it may be stated that no single process development has been more carefully thought out in relation to its complimentary equipment and, none surely, has been more severely tested under practical mill conditions. The manufacturing possibilities open by this process together with economies of its operation, place it at once as one of the outstanding contributions to the textile industry.

Sandoz Dyes

The Sandoz Chemical Works has issued color cards on the following dyes.

Pyrazol Fast Orange 2 GN—This is a new direct cotton color which in its class, is said to show remarkable fastness to light. The manufacturer states that this new dyestuff differs from Pyrazol Fast Orange 2R in its greater clearness of shade and its somewhat yellower tone It is said to give a pure white discharge with hydrosulphite and leave acetate silk pure white when dyeing cotton in the same bath.

Trisulfon Browns—for tinweighted silk. There are five of these browns said to be widely used for dyeing weighted silk in a neutral bath because of their leveling and fastness properties. It is claimed that these dyestuffs will discharge to a white with Hydrosulphite RF.

Fast Silk Yellow GL—This is similar in dyeing properties to Fast Silk Blue 3GL. These colors are said to be particularly adapted for the dyeing of weighted or pure silk in a phosphate of soda, neutral Glauber's salt or soap bath. The card states that it is an excellent printing color and that it discharges to a white with Hydrosulphite RF.

Alizarine Light Violet 2RC—The main advantage of this dye is said to lie in the fact that it is not affected by chrome and may therefore be used for shading mordant colors. It is recommended by the manufacturer for dyeing bathing suits, seaside wear, and for bluing wool and cotton. It is further stated that it is suitable for printing wool, pure and weighted silk.

Fast Silk Sky Blue 6B—This product is intended chiefly for the dyeing of pure and weighted silk and for application printing and color discharge printing on silk wool. It is said to be superior to other bright silk blues in regard to fastness to water and washing with the exception of certain vat colors. It is further said that it is useful for dyeing straw (neutral or acid) and jute either with or without alum.

NEW PATENTS

(*Abstracted by Synthetic Organic Chem. Mfrs. Ass'n*)

Compounds of the Thiazolanthrone Sulphone Series and Process of Making Same. (Valuable dyestuff intermediates.) Heinrich Ritter, of Frankfort-on-the-Main-Fechenheim, and Alfred Holl, of Offenbach-on-the-Main, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,097, July 12, 1932.

New Process for Preparing P-Nitroso-Amine Compounds of the Aromatic Series and the Compounds Obtainable Thereby. (Very reactive compounds for use as dyestuff intermediates.) Karl Schirmacher, of Frankfort-on-the-Main-Hochst, and Hans Sclichenmaier, of Kelkheim in Taunus, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,105, July 12, 1932.

Hydroxy-Benzocarbazole-Carboxylic Acids. (Valuable intermediates for dyestuffs and therapeutical agents.) Albert Schmelzer, Fritz Ballauf, and Heinrich Hefner, of Elberfeld, Ger., assignors, by mesne assignments, to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,106, July 12, 1932.

Production of Complex Metal Compounds of O-Hydroxyazo Dyestuffs. (Dye wool yellow brown to violet shades of good fastness and equalizing properties; may also be used for dyeing leather, printing of cotton, or the production of color lakes.) Hans Krzikalla, of Mannheim, and Karl Holzach and Werner Mueller, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,083, July 12, 1932.

New Water Soluble Diazo Amino Compounds. (Prepared, for example, by diazotizing an aromatic amine with sodium nitrite and hydrochloric acid, adding the diazo solution to a hydrochloric acid solution of the sulfamide and neutralizing the solution.) Anton Ossenbeck, of Cologne-Mulheim-on-the-Rhine, and Ernst Tietze, of Cologne-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,088, July 12, 1932.

Method for the Production of Vat Dyestuffs and the Product Thereof. (Comprises heating an aminobenzanthrone selected from the group consisting of 5-, 6-, 7- and 8-aminobenzanthrones in the presence of an alkaline condensing agent; blue to grey dyeings on cotton, color changing only slightly on chemicking.) Paul Nawiasky, of Ludwigshafen-on-the-Rhine, and Hugo Wolff, of Mannheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,090, July 12, 1932.

Hydroxy-1'.8'-Naphthoylene-Naphthimidazoles. (Valuable intermediates for dyestuffs and pharmaceutical substances.) Wilhelm Neelmeier and Wilhelm Meiser, of Leverkusen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,091, July 12, 1932.

Blue Sulphur Color and Process of Making the Same. (From dinitro-hydroxy-diphenylamine.) George Barnhart, of Salem, N. J., assignor to E. I. du Pont de Nemours & Co., of Wilmington, Del., No. 1,867,202, July 12, 1932.

Azo-Dyestuffs and Process of Making Same. (Valuable new dyestuffs obtained by coupling an arylide of 2:3-hydroxynaphthoic acid with a diazo-compound; red to Bordeaux and violet dyestuffs which, when produced on the fiber, are distinguished by their vividness and excellent fastness properties, particularly to chlorine and kier boiling.) Gerald Bonhote of Basel, Switzerland, assignor to the firm of Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,867,439, July 12, 1932.

Azo-Dyestuffs and Process of Making Same. (Invention permits the production of a large number of intermediate products and dyestuffs, the latter being distinguished for their purity of tint, dyeing capacity and fastness to light.) Joseph Gyr and Otto Kaiser, of Basel, Switzerland, assignors to the firm Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,867,451, July 12, 1932.

Process for Producing an Anthraquinone Dye. (Relates to a process of preparing 1.1'-dihydroxy-2.2'-dianthraquinonyl by reacting upon 1-hydroxy anthraquinone in the presence of a tertiary heterocyclic organic base. A continuation in part of co-pending application Serial No. 251,752, filed Feb. 3, 1928). Walter Mieg, of Opladen, near Cologne, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,858, July 19, 1932.

Indophenol Azine Compounds. (Valuable sulphur dyestuffs dyeing cotton blue shades.) Friedrich Muth, of Elberfeld, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,863, July 19, 1932.

Carbazole-2.7-Disulphonic Acid. (Valuable dyestuff intermediate, produced from the 2.2'-diaminodiphenyl-4.4'-disulhponic acid.) Wilhelm Neelmeier and Otto Goll, of Leverkusen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,867,864, July 19, 1932.

Process for the Manufacture of Monobenzoyldiaminoanthraquinones. (Important dyestuff intermediates prepared by heating a diaminoanthraquinone with benzoyl chloride in the presence of sodium chloride.) Paul E. Thomaschewski, of Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., of Wilmington, Del., No. 1,868,124, July 19, 1932.

Process of Making Condensation Products of the Antraquinone Series and New Products of This Class. (Useful as dyestuff intermediates and dyestuffs, the latter yielding on acetate silk blue to green-blue tints or prints, respectively.) Paul Grossmann, of Basel, Switzerland, assignor to Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,868,202, July 19, 1932.

Dyeing, Printing, and Like Process. (Relates to coloring processes and particularly aims at the securing of improved results by the use of sulphuric esters of cellulose.)

Birkett Wylam and James Stevenson Wilson of Grangemouth, Stirling, Scotland, assignors to Imperial Chemical Industries, Ltd., No. 1,868,300, July 19, 1932.

Aluminum Lakes of 1.4-Dihydroxy- and 1-Amino-4-Hydroxy-Anthraquinone-Disulphonic Acids. (Reddish-violet to bluish-green powders insoluble in water, being valuable and clear pigment dyestuffs of excellent fastness properties especially to light.) Fritz Baumann, of Leverkusen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,868,593, July 26, 1932.

Manufacture of Disazodyestuffs for Dyeing and Printing Wool. (Comprises combining tetrazo compounds of diamino-diphenylmethanedisulphonic acids and their derivatives with two molecules of a naphtholmonosulphonic acid; yield red tints of good fastness properties.) Adolf Krebser, of Basel, Switzerland, assignor to the Firm of J. R. Geigy S. A., of Basel, Switzerland, No. 1,869,063, July 26, 1932.

Manufacture of Disazodyestuffs for Dyeing and Printing Wool. (Comprises combining tetrazo compounds of aminodiphenylmethanedisulphonic acids and their derivatives with two molecules of a pyrazolonesulphonic acid; yield yellow tints of good fastness properties.) Adolf Krebser, of Basel, Switzerland, assignor to the Firm of J. R. Geigy, S. A., of Basel, Switzerland, No. 1,869,064, July 26, 1932.

Azo Dyestuffs and Method of Preparing Same. (From certain amines or aminothiazoles coupled with a 1-amino-5-naphthol-7-sulphonic acid compound; given even red to violet dyeings on viscose silk.) Rainald Brightman, of Manchester, England, assignor to Imperial Chemical Industries, Ltd., of Westminster, England, No. 1,869,930, Aug. 2, 1932.

Azo Coloring Matter Soluble in Benzene. (More particularly the product obtained by coupling amino azo benzene with a naphthol in the presence of formaldehyde.) Leon W. Geller, of Hamburg, N. Y., assignor to National Aniline & Chemical Co., Inc., of N. Y., N. Y., No. 1,870,806, August 9, 1932.

Process of Making Viscose. (A simplified method to provide a viscose perfect sheet of cellophane.) Richard Thurm, of Saginaw, Mich., assignor to Baker Perkins Co., Inc., of Saginaw, Mich., No. 1,871,245, August 9, 1932.

Azo-Dyestuffs Containing Metal and Process of Making Same. (Mainly suitable for dyeing vegetable fibers and silk violet to blue and blue-gray; produced by treating azo-dyestuffs containing lake-forming groups and having affinity for cotton, with agents yielding copper and chromium.) Fritz Straub and Walter Anderau, of Basel, Switzerland, assignors to the Firm Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,871,477, August 16, 1932.

Fast Light Red 4BA

Fast Light Red 4BA is a new Acid Red, manufactured by the General Aniline Works and offered to the trade by the General Dyestuff Corporation, their sole selling agent. Dyed from a Glauber Salt Sulphuric Acid bath it produces a bluish red said to be of very good fastness to light. It is also said to dye very level and is recommended by the manufacturer in combination with Alizarine Direct Blue A2G and Fast Light Yellow 2GX Conc. for the production of mode shades on ladies' dress goods, carpet yarn, etc. The fastness to perspiration, steaming and hot pressing is said to meet the general demands for this class of goods.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

CLASSIFIED

EXPERIENCED SALESMAN - DEMONSTRATOR, Chicago Territory. Has thorough knowledge of all dyestuffs, imported as well as domestic, their application, and the use of all finishing materials, water softeners, penetrators, etc. Practical Dyehouse experience. References. Address Box No. 740, American Dyestuff Reporter, 440 Fourth Avenue, New York.

DYESTUFF SALESMAN—With fifteen years' experience, chiefly in Empire State and New Jersey is at liberty and desirous of position with manufacturing concern. Address Box No. 748, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

BLEACHER, Assistant Dyer (cotton and wool) and Textile Chemist, desires position. Experience in water treatment and development work. Location immaterial. References. Address Box No. 751, American Dyestuff Reporter, 440 Fourth Avenue, New York.

WANTED—For New Jersey concern, *color dyer on skein silk*. Very exact matching required. State age and previous experience. All communications strictly confidential. Address Box No. 752, American Dyestuff Reporter, 440 Fourth Avenue, New York.